

SPECIFIC GRAVITY AND ABSORPTION OF COARSE AGGREGATE FOP FOR AASHTO T 85

Scope

This procedure covers the determination of specific gravity and absorption of coarse aggregate in accordance with AASHTO T 85. Specific gravity may be expressed as bulk specific gravity (G_{sb}), bulk specific gravity, saturated surface dry (G_{sb} SSD), or apparent specific gravity (G_{sa}). G_{sb} and absorption are based on aggregate after 15 hours soaking in water. This procedure is not intended to be used with lightweight aggregates.

Terminology

Absorption – the increase in the mass of aggregate due to water being absorbed into the pores of the material, but not including water adhering to the outside surface of the particles, expressed as a percentage of the dry mass. The aggregate is considered “dry” when it has been maintained at a temperature of $110 \pm 5^{\circ}\text{C}$ ($230 \pm 9^{\circ}\text{F}$) for sufficient time to remove all uncombined water.

Specific Gravity – the ratio of the mass, in air, of a volume of a material to the mass of the same volume of gas-free distilled water at a stated temperature.

Apparent Specific Gravity – the ratio of the mass, in air, of a volume of the impermeable portion of aggregate to the mass of an equal volume of gas-free distilled water at a stated temperature.

Bulk Specific Gravity – the ratio of the mass, in air, of a volume of aggregate (including the permeable and impermeable voids in the particles, but not including the voids between particles) to the mass of an equal volume of gas-free distilled water at a stated temperature.
Bulk Specific Gravity (SSD) – the ratio of the mass, in air, of a volume of aggregate, including the mass of water within the voids filled to the extent achieved by submerging in water for approximately 15 hours (but not including the voids between particles), to the mass of an equal volume of gas-free distilled water at a stated temperature.

Apparatus

- Balance or scale with a capacity of 5 kg, sensitive to 1 g. Meeting the requirements of AASHTO M 231.
- Sample container, wire basket of 3.35 mm (No. 6) or smaller mesh, with a capacity of 4 to 7 L (1 to 2 gal) to contain aggregate with a nominal maximum size of 37.5 mm (1 1/2 in.) or smaller; larger basket for larger aggregates.
- Water tank, watertight and large enough to completely immerse aggregate and basket, equipped with an overflow valve to keep water level constant.
- Suspension apparatus: wire used to suspend apparatus shall be of smallest practical diameter.
- Sieves, 4.75 mm (No. 4), or other sizes as needed, conforming to AASHTO M 92.

Sample Preparation

1. Obtain the sample in accordance with the FOP for AASHTO T 2.
2. Mix the sample thoroughly and reduce it in accordance with the FOP for AASHTO T 248.
3. Reject all material passing the 4.75 mm (No. 4) sieve by dry sieving and thoroughly washing to remove dust or other coatings from the surface. The minimum mass is given in Table 1.

Note 1: If this procedure is used only to determine the Bulk SpG of oversized material for AASHTO T99 or T 180 and in the calculations for T 224 the material can be rejected over the appropriate sieve. T99 and 180 methods A & B 4.75 mm (No.4). T 99 & 180 methods C & D the 19 mm (3/4 in)

Table 1

Nominal Maximum Size mm (in.)	Minimum Mass of Test Sample, kg (lb)
12.5 (1/2) or less	2 (4.4)
19.0 (3/4)	3 (6.6)
25.0 (1)	4 (8.8)
37.5 (1 1/2)	5 (11)
50 (2)	8 (18)
63 (2 1/2)	12 (26)
75 (3)	18 (40)

Procedure

1. Dry the test sample to constant mass at a temperature of $110 \pm 5^{\circ}\text{C}$ ($230 \pm 9^{\circ}\text{F}$) and cool in air at room temperature for 1 to 3 hours.

Note 2: Where the absorption and specific gravity values are to be used in proportioning concrete mixtures in which the aggregates will be in their naturally moist condition, the requirement for initial drying to constant mass may be eliminated, and, if the surfaces of the particles in the sample have been kept continuously wet until test, the 15-hour soaking may also be eliminated.

2. Immerse the aggregate in water at room temperature for a period of 15 to 19 hours.

Note 3: When testing coarse aggregate of large nominal maximum size requiring large test samples, it may be more convenient to perform the test on two or more subsamples, and then combine values obtained.

3. Remove the test sample from the water and roll it in a large absorbent cloth until all visible films of water are removed. Wipe the larger particles individually.

Note 4: A moving stream of air may be used to assist in the drying operation, but take care to avoid evaporation of water from aggregate pores.

4. Determine the SSD mass of the sample, and record this and all subsequent masses to the nearest 1.0 g or 0.1 percent of the sample mass, whichever is greater. Designate this mass as "B".

5. Inspect the immersion tank to insure the water level is at the overflow outlet height. Place the SSD test sample in the sample container and weigh it in water maintained at $23.0 \pm 1.7^{\circ}\text{C}$ ($73.4 \pm 3^{\circ}\text{F}$). Shake the container to release entrapped air before recording the weight. Designate this submerged weight as “C”.

Note 5: The container should be immersed to a depth sufficient to cover it and the test sample during mass determination. Wire suspending the container should be of the smallest practical size to minimize any possible effects of a variable immersed length.

6. Dry the test sample to constant mass at a temperature of $110 \pm 5^{\circ}\text{C}$ ($230 \pm 9^{\circ}\text{F}$) and cool in air at room temperature for 1 to 3 hours. Designate this mass as “A”.

Calculations

Perform calculations and determine values using the appropriate formula below. In these formulas, A = oven dry mass, B = SSD mass, and C = weight in water.

Bulk specific gravity (G_{sb})

$$G_{sb} = A / (B - C)$$

Bulk specific gravity, SSD (G_{sb} SSD)

$$G_{sb} \text{ SSD} = B / (B - C)$$

Apparent specific gravity (G_{sa})

$$G_{sa} = A / (A - C)$$

Absorption

$$\text{Absorption} = [(B - A) / A] \times 100$$

Sample Calculations

Sample	A	B	C	B - C	A - C	B - A
1	2030.9	2044.9	1304.3	740.6	726.6	14.0
2	1820.0	1832.5	1168.1	664.4	651.9	12.5
3	2035.2	2049.4	1303.9	745.5	731.3	14.2

Sample	G_{sb}	G_{sb} SSD	G_{sa}	Absorption
1	2.742	2.761	2.795	0.689
2	2.739	2.758	2.792	0.687
3	2.730	2.749	2.783	0.698
Average	2.737	2.756	2.790	0.691

These calculations demonstrate the relationship between G_{sb} , G_{sb} SSD, and G_{sa} . G_{sb} is always lowest, since the volume includes voids permeable to water. G_{sb} SSD is always intermediate. G_{sa} is always highest, since the volume does not include voids permeable to water. When running this test, check to make sure the values calculated make sense in relation to one another.

Report

Results shall be reported on standard forms approved by the agency. Report specific gravity values to 3 decimal places and absorption to 0.1 percent.